

淮南矿区煤层气项目招商报告

Investment Opportunities in Coal Mine Methane Projects in Huainan Mining Area

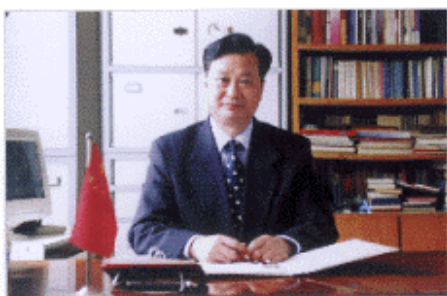


United States Environmental Protection Agency



China Coalbed Methane Clearinghouse

April 2001 Beijing



Chairman: Wang Jinrong



President: Tang Zhengkai

Dear Colleague,

Huainan Mining Group Co., Ltd. is one of the national 520 key enterprises, which has a coal mining history over 80 years, and the coal production reached 13.25 million ton in 1999. Its registered capital is 3.12 billion yuan. The total assets by the end of 2000 were 17.755 billion yuan and the annual sales income was 3.733 billion yuan. The company has a total of 129,859 employees.

During the Sixth and Seventh Five-Year Plan periods, Huainan coalfield was listed as one of the national key areas for the research of coalbed methane exploration technology. Coalbed methane resources are about 592.8 billion m³, the density of coalbed methane resources reaches 264.4 million m³/km². In 2000 the pure methane recovered by 7 underground gas drainage systems was up to 50 million m³ each year. At present, part of recovered methane has been utilized as town gas and industrial boiler fuel in the mining area. Coalbed methane development and utilization will be implemented in stages. The risky exploration will be conducted first, based on which, and supported by the

national project of the gas transport from west to east, a large-scale development will be carried out.

Currently, gas consuming population in Huainan city has reached 1.1 million, approximately 315,300 households with the gas demand of 115 million m³/a. At present, the annual power consumption in the mining area is approximately 1 billion kWh. With the new mines reaching the designed capacity and putting into operation, the electricity demand in the mining area will be increased greatly. In addition, Huainan Mining Group Co., Ltd. has planned to build necessary coal chemical projects. Investors are welcome to come to Huainan for technical and economic cooperation.

Sincerely,

A small, square, red ink stamp containing the Chinese characters '王金荣' (Wang Jinrong).

Wang Jinrong
Chairman, Huainan Mining Group Co., Ltd.

Executive Summary

Background

The Huainan Mining Group Co., Ltd. is a large State-owned coal production base. Total planned coal production capacity is 37.6 million tonnes per annum (Mt/a), and coal production in 2000 was 15.6 Mt.

Total coalbed methane resources belonging to the Huainan Mining Group Co., Ltd. are estimated at 592.8 billion m³. Strong potential for the development of these resources exists, and there is a broad market for utilization of the recovered gas. The coalbed methane field covers about 2,242 km², average density of coalbed methane resources reaches 264.4 million m³ per km², and the average CH₄ concentration of the gas in most of the unmined areas is over 85%.

Current emission of coal mine gas is 600 m³/min, and annual methane emissions are 311 million m³, ranking Huainan third in methane emissions among Chinese coal enterprises. In 2000, coalbed methane drainage from the Huainan mining area was nearly 50 million m³ (Mm³). It is predicted that the annual coalbed methane drainage will reach 80 million m³ by 2002, 100 Mm³ by the year 2005 and 200 to 250 Mm³ by the year 2015. By that time, Huainan Mining Group will enjoy a leading position among Chinese coal companies.

Investment Opportunities

Following is a summary of the two potential CMM utilization projects for which the Huainan Mining Group is seeking investment:

(1) *CMM household utilization project* At present, the main purpose of coalbed methane drainage in the Huainan mining area is to ensure mining safety. Only CMM recovered from the Xieyi and Xie'er coal mines is used by residents in the mining area as fuel. The proposed project would expand CMM utilization to other mines, and would use 74 million m³ of CMM annually, recovered from seven permanent gas drainage systems. The project would include construction and installation of gas storage facilities, a pipeline network, and auxiliary equipment and infrastructure. Total cost of this project is estimated at 178.25 million yuan (\$US 21.5 million). Of this total, Huainan Mining Group would provide 30%, and is seeking the remaining 70% from outside investment or financing sources. Based on the total investment of 178.25 million yuan (\$US 21.5 million), the estimated net present value would be 91.67 million yuan (\$US 11.1 million), the internal rate of return would be 20%, and the payback time would be 7 years. Huainan Mining Group proposes to begin the project in 2002 and anticipates that it would be fully implemented by 2004.

(2) *CMM power generation project* The proposed project would build a CMM-fueled power

plant with a capacity of 3 x 1000 kW that would provide electricity to facilities in the mining area. The plant would utilize 6 million m³ of methane annually. The project would entail purchase and installation of gas engines. Total cost of the project is estimated at 17.8 million yuan (\$US 2.14 million). Of this total, Huainan Mining Group would provide 35%, and is seeking the remaining 65% from outside investment or financing sources. Based on the total investment of 17.8 million yuan (\$US 2.14 million), the estimated net present value would be 4.59 million yuan (\$US 0.55 million), the internal rate of return would be 22%, and the payback time would be 7 years. Huainan Mining Group proposes to begin the project in 2002 and anticipates that it would be fully implemented by 2003.

Huainan Mining Group recognizes that investment in these projects entails certain inherent risks, such as potential fluctuations in CMM and electricity sales prices. Huainan Mining Group can help potential investors determine the potential range of CMM and electricity sales prices for use in economic modeling of project potential. Huainan Mining Group is also prepared to address investors' concerns with other important issues such as repatriation of funds.

Huainan Mining Group is willing to consider various types of partnerships and financing sources in order to realize the proposed projects. Representatives of banks, foreign companies, foreign governments and international agencies are encouraged to review the attached marketing package and contact us for more information:

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1. Overview

The Huainan coalfield, about 3,000 km² in area, is situated on the middle reaches of the Huaihe River in Anhui province. It is close to the economically developed East China region and the Yantze River delta. Transportation is very convenient with railways, highways and waterways radiating in all directions. It is about 100 km from Hefei, the capital of Anhui province, 300 km from Nanjing and 500 km from Shanghai (Figure 1). With large coal reserves, the Huainan mining area is one of the large coal producing areas in China. Its estimated coal reserves are nearly 80 billion tons and coal mine methane (CMM) resources are about 548.2 billion m³. The CMM recovery method adopted in the Huainan mining area is underground gas drainage. CMM drainage was 49.4 million m³ (Mm³) in 2000 and is estimated to reach 80 Mm³ by 2002. At present, only CMM recovered from the Xieyi and Xie'er Mines is utilized as town gas in the mining area. In 2000, total CMM utilization reached 8.4 Mm³.



Fig. 1 Location of the Huainan Mining Area

According to market conditions in the Huainan region, the most practical utilization option for CMM is as a household fuel, and secondarily for power generation. The proposed CMM household utilization project mainly uses CMM recovered from the seven permanent gas drainage systems. The Huainan mining area is divided into the Panji and Xinxie Blocks, and CMM in these two blocks is supplied to residents in Huainan City through the gas storage and distribution system and pipeline network. Annual CMM utilization quantities of the proposed project would be about 73.9 Mm³ and the service life of the project is 40 years.

The proposed CMM power generation project would build a CMM-fueled power plant with a capacity of 3x1000 kW to provide electricity to auxiliary equipment in the mining area. The power plant will be fueled with CMM recovered from the Panyi and Pansan Mines. This project would use 6 Mm³ of CMM, and the proposed service life is 20 years.

Table 1. Financial Analysis Results of CMM Utilization Projects in the Huainan Mining Area

Project	Total Investment (million yuan)	Sales Revenue (million yuan/a)	NPV (million yuan)	IRR (%)	Pt (year)
CMM Household Utilization	178.25	81.32	91.67	20	7
CMM Power Generation	17.81	8.80	4.59	22	7

Currently, the Huainan Mining Group Co., Ltd. is in the process of applying preferential loans of 140 million yuan from the Industry and Commercial Bank for the town gas project, and is seeking foreign investment to cover the rest of the investment. With the success of coalbed methane (CBM) surface development in the Xinji Area, the Huainan Mining Group Co., Ltd. hopes foreign companies can carry out the risk exploration activities needed to develop CBM resources in the Huainan mining area. The Chinese central government has approved the Huainan CBM block for foreign cooperation.

2. Introduction of the Enterprise

Huainan Mining Group Co., Ltd. is one of 520 large State-owned key enterprises. Total assets of the Huainan Mining Group Co., Ltd. are 14 billion yuan. Total planned production capacity is 37.60 Mt/a, present planned production capacity is 19 Mt/a, and the annual coal production in 2000 was 15.60 Mt. It is estimated that coal production in 2010 will reach 40 Mt. Current and planned coal production of the Huainan mining area are shown in Table 2. The location of mines in Huainan mining area is shown in Figure 2.

Table 2. Coal Production and Planned Production of Huainan mining area

Mine	Designed Capacity (Mm ³ /a)	Approved capacity (Mm ³ /a)	Coal Production(Mm ³ /a)		
			2000	2005	2010
Xinzhuangzi	2.70	1.90	2.08	2.00	2.40
Xieyi	0.90	1.40	1.69	1.60	1.80
Panyi	3.00	3.00	2.61	3.00	3.00
Pansan	3.00	3.00	2.24	3.00	3.00
Xieqiao	4.00	4.00	2.65	4.00	4.00
Zhangji	4.00	4.00		4.00	4.00
Guqiao	5.00	5.00			5.00
Dingji	3.00	3.00			2.00
Xie' er	0.90	0.90	0.90		
Liyi	0.90	0.75	0.84	1.20	1.20
Li' er	0.45		0.33		
Kongji	0.90	0.45	0.36	0.75	0.40
Lizhuizi	0.30	0.30	0.39		
Pan' er	2.10	1.00	0.81	0.80	1.20

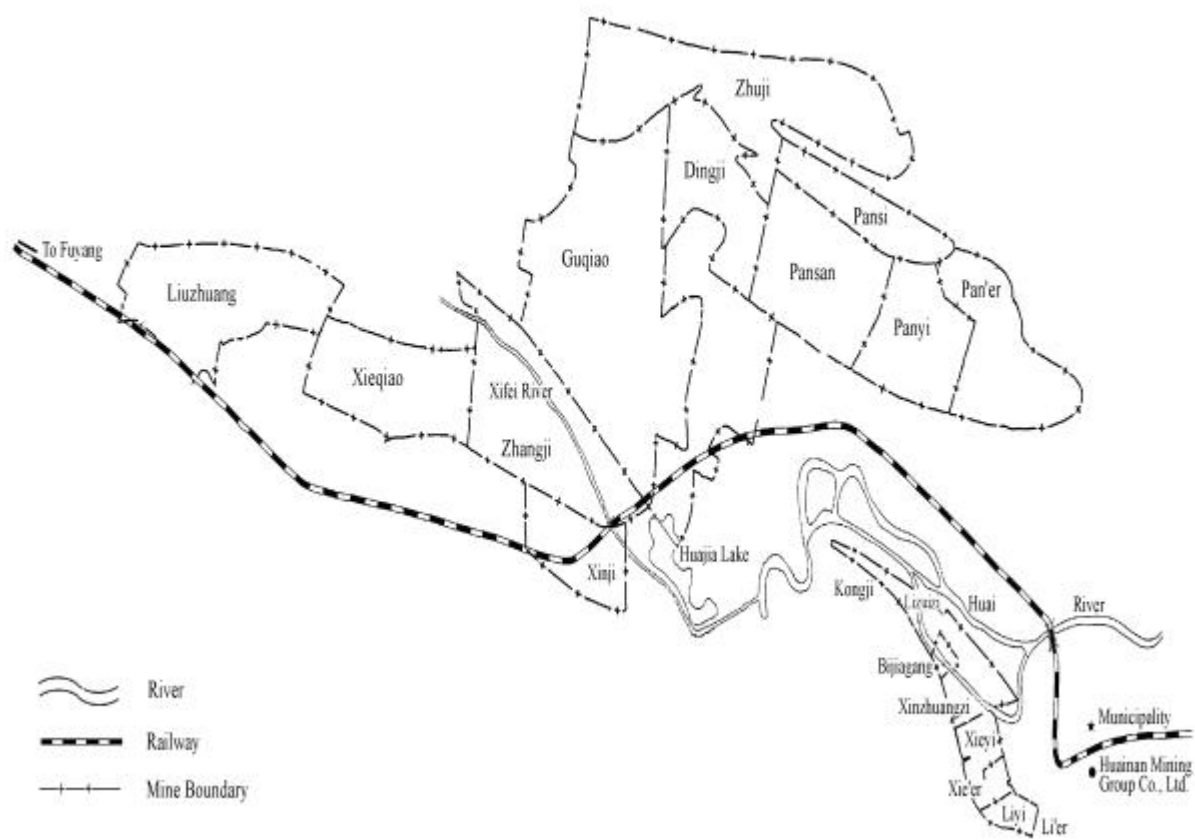


Fig2. Location of mines in Huainan Mining Area

In 2000, coalbed methane drainage from the Huainan mining area was nearly 50 million m³. It is predicted that the annual coalbed methane drainage will reach 80 Mm³ by 2002, 100 Mm³ by the year 2005 and 200 to 250 Mm³ by the year 2015. By that time, Huainan Mining Group will enjoy a leading position among Chinese coal companies.

3. Coalbed Methane Resources

The Permo-Carboniferous coal-bearing strata of the Huainan coalfield contain about 32 to 40 closely spaced coal seams with a total thickness of 42 m. The minable coal seams are distributed in the middle lower part of the Permian strata. Thickness of the workable coal seam section is about 350 m, containing 9-18 workable coal seams with a total thickness of 18-34 m. Table 3 lists basic parameters for evaluation of the development potential of the Huainan coalfield.

Table 3. Basic Parameters of the Huainan Coalfield

Item	Data
Buried depth (m)	500-1500
Main coal rank	Bituminous coal
Vitrinite reflectance R_{\max}^0 (%)	0.8-1.48
Gas content (m ³ /t)	2.05-15.88
Langmuir volume V_L (m ³ /t)	18.08
Langmuir pressure P_L (Mpa)	3.81
CBM resources (billion m ³)	592.83
Density of CBM resources (Mm ³ /km ²)	140
Predicted coal seam permeability	Normal

4. Status of CMM Recovery and Utilization

Coal mines in the Huainan mining area are gassy and prone to coal and gas outburst. Ten of the 11 producing coal mines are high-gas and coal and gas outburst mines. Along with increasing mining depth, gas emissions will increase sharply. Gas drainage has become compulsory. Currently, the emission of gas from the mining area is as high as 600 m³/min and annual emissions are 311.0 Mm³, ranking third in China. Seven permanent gas drainage systems have been built in Huainan mining area with the total capacity of 143 million m³/a, but the capacity has not been fully used so far. The annual gas drainage quantities of Huainan mining area are shown in Table 4. Huainan Mining Group Co., Ltd. will retrofit the drainage pipelines and equipment, and then the CMM recovery can be increased. It is predicted that the annual CMM drainage quantities will reach 80 Mm³ by 2002.

The national 9th Five-Year key R&D project known as the Xinji CBM Development Demonstration Project started to construct the first exploration test well SX-2 in March 1998. Up to February 2001, three surface wells have been drilled and fractured, with the highest single well gas production reaching 3,200 m³/d. It is estimated that single well gas production

will reach 6,000 m³/d with the further dewatering of the surface well.

Table 4. CMM Drainage of the Huainan Mining Area

Year	Methane drainage (Mm³)
1990	5.06
1993	4.20
1995	5.00
1996	6.60
1997	10.45
1998	22.60
1999	37.60
2000	49.40

At present, the main purpose of gas drainage in the Huainan mining area is to ensure mining safety. Only CMM recovered from the Xieyi and Xie' er coal mines is used by residents in the mining area as household fuel. By 2000, the utilization of CMM from the Xieyi Mine reached 3.23 million m³ with a utilization rate of 41% of the methane drained, and that of Xie' er Mine reached 5.20 million m³ with a utilization rate of 56%.

5. CMM Household Utilization Project

5.1 Overview of the Project

This project would mainly utilize CMM recovered from the permanent gas drainage systems in six coal mines. It would divide the Huainan mining area into two blocks, Panji Block and Xinxie Block (CBM resources are shown in Tables 5 and 6). CMM recovered from these two blocks will be transported through a storage and distribution system and pipeline network to the residents in the Panji, Tianjiayan, Bagongshan and Xiejiaji districts of Huainan city. In the Panji Block, two sets of low-pressure wet gas storage tanks with a capacity of 50,000 m³ each and a pipeline network of 75.02 km will be built. In the Xinxie Block, two sets of low pressure wet gas storage tanks with a capacity of 30,000 m³ each, one set of low pressure wet gas holders of 20,000 m³ capacity, a pipeline network of 143.15 km, and auxiliary equipment and infrastructure will be built. The total investment required of this project is about 178.25 million yuan.

Table 5. CBM Resources in the Xinxie Block

Mine	Calculated Depth (m)	Geological Coal Reserves (10⁶t)	Recoverable Coal Reserves (10⁶t)	CBM Resources (billion m³)
Xinzhuangzi	-1000	298	174	3.84
Xieyi	-660	53	27	0.75
Xie' er	-660	31	15	0.49
Liyi	-660	17	8	0.21
Xielishen	-660 to -1200	522	287	9.49
Total		951	511	14.74

Table 6. CBM Resources in the Panji Block

Mine	Calculated Depth (m)	Geological Coal Reserves (10 ⁶ t)	Recoverable Coal Reserves (10 ⁶ t)	CBM Resources (billion m ³)
Panyi	-800	725	425	9.88
Pansan	-900	804	396	9.87
Total		1529	821	19.75

The project has two separate gas supply systems for the Xinxie and Panji blocks, which are not interconnected. The gas supply capacities of these two blocks are shown in Table 7.

Table 7. Gas Supply Capacity

	Xinxie Block	Panji Block
CMM drainage (m ³ /min)	77.6	70.5
Number of households supplied	119,700	108,800

5.2 Financial Analysis

The Corporation is planning to apply for loans from financing organizations for 70% of the investment of the project, and raise by itself 30% of the investment. Assumptions for the financial analysis of the project are shown in Table 8. The results of financial analysis and sensitivity analysis are shown in Tables 9 and Figure 3, respectively. Results of the sensitivity analysis show that the price of CMM will have a strong influence on the economic performance of the project.

Table 8. Assumption Conditions for the Financial Analysis of the CMM Household Utilization Project

Item	Data	Source
Wellhead price of CMM	0.20 yuan/m ³	
Real discount rate	12%	State Development Planning Commission
Inflation rate	3%	State Development Planning Commission

Table 9. Financial Analysis Results of the CMM Household Utilization Project

Item	Data
Investment	178.25 million yuan
Annual sales revenue	81.32 million yuan
Annual operating cost	47.14 million yuan
NPV	91.67 million yuan
IRR	20%
Pt	7 years

5.3 Analysis of Emission Reduction

When the project is to put into operation, about 73.9 million m³ of methane will be used as town gas annually. Based on the calorific values of raw coal and coalbed methane, thermal efficiency of coalbed methane combustion is 60% and that of raw coal burning is 15%, 1 m³ of coalbed

methane can replace 4.72 kgce. By implementing this project, a total of 348,000 tce will be saved. Implementation of this project will also reduce emissions of pollutants that would be caused by coal combustion. Ash content, sulfur content and calorific value of coal produced in Huainan coal mining area are 25%, 0.5% and 5600kcal/kg, respectively, implementation of this project would result in the reduction of fly ash emission by 5,593 t, slag reduction by 106,300 t and SO₂ emission reduction by 4,474 t.

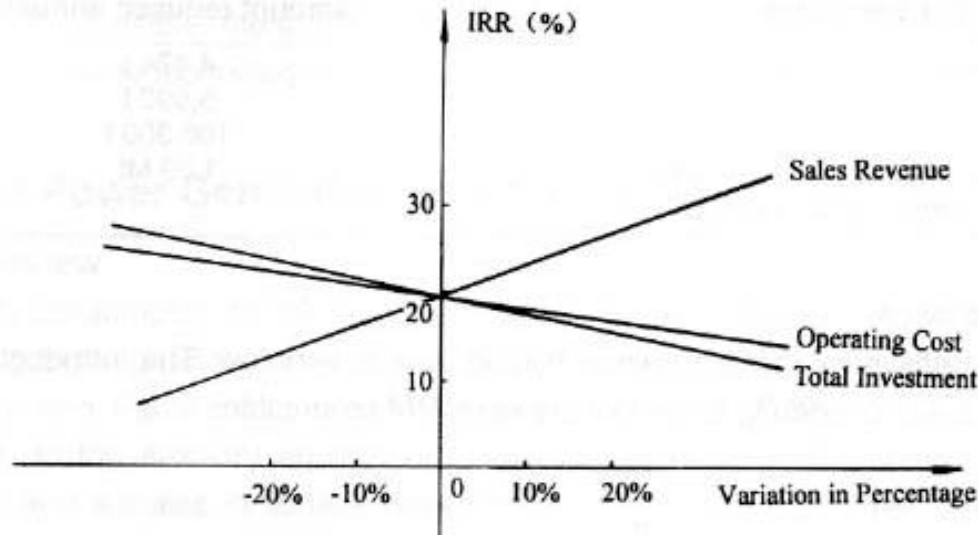


Fig3. Sensitivity Analysis Curve

The use of coalbed methane as town gas will reduce the emission of methane of 73.9 million m³, corresponding to the reduction of emission of 1.11 Mt t of CO₂. In face, burning of 73.9 million m³ of coalbed methane will produce 145,100 t of CO₂. On the other hand, the implementation of this project will save a total of 348,000 tce. On account of the calculation of CO₂ emissions of 2.66 kg from the burning of 1 kg of coal equivalent (ce), this project can avoid the coal burning related CO₂ emission of 925,700 t. In total, implementation of this project can achieve the emissions reduction of CO₂ by 1.89 Mt.

Based on the operating cost of this project being 47.14 million yuan per year and a CO₂ equivalent reduction of 1.89 Mt, the cost for reduction of each ton of CO₂ is 24.9 yuan.

$$47.14 \text{ million yuan} / 1.89 \text{ Mt} = 24.9 \text{ yuan/t-CO}_2$$

The project will save a total of 348,000 tce, which corresponds to 447,000 t of raw coal. Price of raw coal is 160 yuan/t, so implementation of this project will save the raw coal cost of 71.59 million yuan. Therefore the incremental cost for the CO₂ emission reduction is -12.90 yuan/t-CO₂.

$$(47.14 - 71.59) \text{ million yuan} / 1.89 \text{ Mt} = -12.90 \text{ yuan/t-CO}_2$$

Table 10 summarizes the environmental benefits of the project.

5.4 Analysis of Obstacles and Solutions

At present, the CMM project in the Huainan mining area mainly has the following obstacles:

(1) Lack of Funds

Because coal supply has been higher than the demand in recent years, the operating conditions of coal enterprises are not very good. It is difficult for them to have enough funds for CMM projects. This project urgently needs external investment for start up.

Table 10 Emissions Reductions of CMM Household Utilization Project

Type of Emissions	Amount reduced annually
Sulfur dioxide	4,474 t
Fly ash	5,593 t
Slag	106,300 t
Greenhouse gases (CO ₂ plus CH ₄ expressed in terms of CO ₂ equivalent	1.89 Mt

(2) Lack of Technologies

The CMM drainage efficiency in the Huainan mining area is very low. The introduction of new drainage technologies is needed in order to increase CMM production.

(3) Management Problems

Management problems for the CMM household utilization project in the Huainan mining area cover CMM supply and profit allocation. Huainan Mining Group Co., Ltd., supplier of the CMM, may face conflicts regarding profit sharing with Huainan Gas Company, which is responsible for CMM marketing.

To overcome obstacles to implementing the project, Huainan Mining Group Co., Ltd. urgently needs two kinds of partners, i.e. investors and technology suppliers. Thus, the following measures are proposed:

(1) Getting funds from different financial channels

Huainan Mining Group Co., Ltd. sincerely welcomes private investors from China and abroad, as well as foreign governments and financing institutions to invest in the Huainan CMM household utilization project. At the same time, the Corporation is making every effort to get low-interest State loans. According to the development practice of CMM projects at home and abroad and the specific conditions of the Huainan mining area, the following financing channels can be adopted for the CMM household utilization project in the Huainan mining area:

- Raising of funds
- Government allocation of funds
- Bank loans
- Investment of foreign companies
- Preferential loans of foreign governments
- International Agencies

(2) Introducing technologies and providing technical training

(3) Setting up a CMM company

We suggest that Huainan City and Huainan Mining Group Co., Ltd. jointly implement this Huainan CMM project and set up a CMM Utilization Company as an independent legal entity so as to ensure the smooth implementation, operation and management of the project.

5.5 Project Risk Analysis

Although preliminary analysis indicates that the Huainan CMM town gas project would be economically feasible, there are certain inherent risks, such as the risk caused by utilization of new gas drainage technologies and the risk caused by fluctuation of the sales price of CMM.

6. CMM Power Generation Project

6.1 Overview

Electricity consumption in the Huainan mining area is 1 billion kWh/a, all from the national grid. According to the practical conditions of Huainan, we can consider utilizing CMM recovered from the Panyi and Pansan Mines to fuel a 3×1000 kW CMM power plant that would provide electricity to the auxiliary equipment in the mining area. With increased underground CMM drainage and success in surface development, total CMM production will be increased. CMM power generation is a promising option for CMM utilization.

The proposed project would use gas engines for power generation. The construction period of the project is 10 months and annual power generation is about 21×10^6 kWh. The main economic and technical indices of the CMM power plant are shown in Table 11.

Table 11. Main Technical and Economic Parameters of the CMM Power Plant

Item	Data
Installed Capacity	3×1000 kW
Electricity Generated	21.6×10^6 kWh
Electricity Supplied	20.0×10^6 kWh; 6% for own use, 1.5% line loss
CMM Consumption	6 Mm ³ /a
Average Heat Rate	0.303 m ³ /kWh

6.2 Financial Analysis

The total estimated capital investment for this project will be 17.8 million yuan. The project considers getting 65% of the capital investment from the loans of financing organizations concerned and the rest can be raised by the enterprise itself. The assumption conditions for the financial analysis of this project are shown in Table 12 and the results of financial analysis and sensitivity analysis are shown in Tables 13 and Figure 4, respectively. The analysis results indicate that this project would be profitable, and the price of electricity has the strongest influence on the economic performance of the project.

6.3 Analysis of Emission Reduction

When put into operation, the methane power generation project will consume 6.0 million m³ of pure methane annually. On the basis of 373 g/kWh, the average heat rate of conventional coal

fired power plants in China, an annual savings of 8057 tce can be realized.

Table 12. Assumptions for the Financial Analysis of the CMM Power Generation Project

Item	Data	Source
Price of CMM	0.40 yuan/m ³	
Real discount rate	12%	State Development Planning Commission
Inflation rate	3%	State Development Planning Commission

Table 13. Financial Analysis of the CMM Power Generation Project

Item	Data
Investment	17.81 million yuan
Annual sales revenue	8.8 million yuan
NPV	4.95 million yuan
Annual operating cost	5.895 million yuan
IRR	22%
Pt	7 years

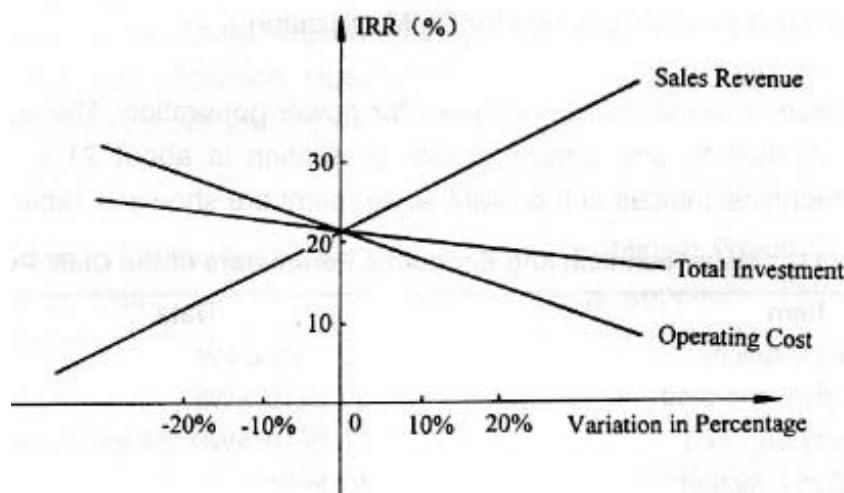


Fig4. Sensitivity Analysis Curve

Pollutant emissions can be also reduced remarkably by using CMM instead of coal to generate electricity. Currently the heating value, sulfur and ash content of coal produced in the Huainan mining area average at 5600kcal/kg, 0.5% and 25% respectively. Coalbed methane used as fuel for power generation will reduce SO₂ emissions by 103.6 t, 2460.3 t of slag and 129 t of fly gas.

The project will reduce methane emissions by 6.0 million m, which is equivalent to 89,000 t CO₂. As to CO₂ emissions from burning the fuels, combustion of 1 m³ of pure methane emits 1.84 kg of CO₂, whereas combustion of 1 kg of coal emits 2.66 kg of CO₂. On annual base, the combustion of 6.0 million m³ will emit 11,800 t CO₂, in contrast, consuming 10,700 t of coal would emit 21,400 t of CO₂. Thus the reduction in CO₂ emissions due to combustion alone would be 9600 t of CO₂.

In summary , the project would reduce annual greenhouse gas emissions as follows:
 $(\text{CO}_2 \text{ equivalent of CH}_4 \text{ captured}) + (\text{CO}_2 \text{ reduction from combusting CH}_4 \text{ instead of coal}) = 89,000 \text{ t} + 9,600 \text{ t} = 98,600 \text{ t CO}_2 \text{ equivalent annually}$

The annual operating cost of this project will be 5.9 million yuan and the reduction of CO₂ will be 98,600 t. Thus, we can see the emission reduction cost per ton of CO₂ as follows:

$$5.9 \text{ million yuan} / 98,600 \text{ t} = 59.84 \text{ yuan/ t-CO}_2$$

Under the assumption that the coal is used instead and coal-fired power plant operating cost in east China area is averaged at 0.16 yuan/kWh and the power plant in this project produces an annual total of 21.60 million kWh of electricity, the annual operating cost will be 3.46 million yuan. Therefore, the incremental cost for CO₂ emission reduction is as follows:

$$(5.9 - 3.46) \text{ million yuan} / 98,600 \text{ t} = 24.75 \text{ yuan/ t-CO}_2$$

Table 14 summarizes the environmental benefits of this project.

Table 14 Emissions reductions of CMM Power Generation Project

Type of Emissions	Amount reduced annually
Sulfur dioxide	103.6 t
Fly ash	129 t
Slag	2460.3 t
Greenhouse gases (CO ₂ plus CH ₄ expressed in terms of CO ₂ equivalent	98,600 t

6.4 Analysis of Obstacles and Solutions

The main obstacles facing the CMM power generation project in the Huainan mining area are as follows:

(1) Lack of Funds

This would be a demonstration project. Along with the increase of CMM production, we may eventually consider building a large-scale CMM power plant for peak shaving, which will need more investment. However, because coal supply is higher than demand in recent years, the operating conditions of coal enterprises are not very good. It is difficult for them to have enough funds for CMM projects.

(2) Lack of Technologies

The gas engine power generators manufactured domestically are small in scale and poor in reliability. Therefore, highly efficient foreign gas engine power generation technology is needed.

In order to overcome obstacles to the implementation of the CMM power generation project, Huainan Mining Group Co., Ltd. urgently needs two kinds of cooperation partners, i.e. investors and technology suppliers. Therefore the following measures are proposed:

(1) Getting funds from different financial channels

Huainan Mining Group Co., Ltd. sincerely welcomes private investors in China and abroad, as well as foreign governments and institutions to invest in the Huainan CMM power generation project. According to the development practice of CMM projects at home and abroad, and the specific conditions of the Huainan mining area, the following financing channels can be adopted for the CMM power generation project in the Huainan mining area:

- Raising of funds
- Bank loans
- Investment from foreign companies
- Preferential loans from foreign governments
- International agencies

(2) Lease of equipment

The lease of equipment from suppliers can be considered and the equipment investment can be recovered from the project income, so that the project risks and investment can be reduced.

(3) Technical training

The power generator manufacturer is responsible for conducting technical training for power plant technicians and workers.

6.5 Risk Analysis of the Project

Although the proposed CMM power generation project has been proven economically feasible, there are still certain risks. For instance, the quantity and quality of CMM supply, reliability of power generation equipment, and fluctuations in CMM and electricity prices all constitute risks.

7. Conclusions and Suggestions

- (1) The Huainan mining area has abundant coal resources with reserves as high as 80 billion t. At the same time, CBM resources in the area are 548.2 billion m³. Gas content of coal seams in the Huainan mining area ranges from 2.1 to 15.9 m³/t and the burial depth of the coal seams is moderate, very suitable to CBM development.
- (2) The Huainan mining area is located in the East China region where energy is in great shortage. There are many medium-sized cities around the mining area, and the market for CMM is therefore good.
- (3) With the setting of the underground gas drainage project in the Huainan mining area and promotion of the surface recovery project, CMM production will be continuously increased. It is predicted that by 2002, the underground drainage quantities of CMM will reach 70 Mm³.
- (4) The household utilization technology of CMM in the Huainan mining area is relatively mature, but by 1998, CMM utilization in the Huainan mining area was only 24% of that which was drained.
- (5) According to the development status and market conditions of CMM in the Huainan mining area, near-term priority CMM projects are the proposed town gas and power generation

projects. From a long-term point of view, CMM recovered in the Huainan mining area could be supplied to nearby large and medium-sized cities, a CMM power plant for peak load shaving could be constructed, and CMM could be supplied to the chemical industry.

- (6) The CMM projects of the Huainan mining area can be implemented via cooperative joint venture and equipment lease. Potential financing sources for the project can include investment from foreign companies, low interest loans from foreign governments, and self-raised funds of the enterprise.
- (7) At present, the main obstacle preventing the market development of CMM in the Huainan mining area is the lack of funds and technologies.
- (8) The main risks in the implementation of the proposed project concern use of new technologies and fluctuating CMM and electricity prices.

In order to encourage market development of CMM in the Huainan mining area and promote the development of the CBM industry, the following suggestions are made:

- (1) Foreign funds and technologies should be actively introduced to speed up construction of CMM infrastructures and implementation of CMM projects in the Huainan mining area.
- (2) CMM recovery and utilization plans should be worked out and perfected, and various funding sources from central and local governments should be used of to develop CBM resources in the Huainan mining area.
- (3) A special management agency for the development of CMM recovery and utilization should be set up. We propose to set up the Huainan CMM Utilization Company as an independent entity to carry out the CMM projects.
- (4) CMM market development should abide by the principle of developing small projects before larger ones and serving the local area before more distant regions. CMM drained from underground is to be supplied for household fuel and power generation, while CBM recovered from the surface is to be supplied to large and medium-sized cities around the area for household utilization, construction of a CMM power plant for peak load adjustment, and chemical feedstock production.

China Coalbed Methane Clearinghouse

China Coalbed Methane Clearinghouse (CBMC), was established in August 1994 jointly by the former Ministry of Coal Industry, PRC and the US Environmental Protection Agency (USEPA). The Clearinghouse is part of the China Coal Information Institute. The goal of the Clearinghouse is to promote the development of coalbed methane recovery and use in China.

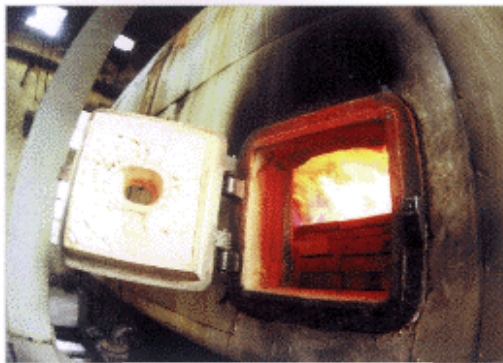
The Clearinghouse undertakes a variety of activities, including:

- Providing consulting services to developers, including financial, market, and economic analyses of potential coalbed methane projects;
- Creating a domestic industry network for information exchange and project development and connecting potential developers with these contacts;
- Providing logistic support to representative of foreign organizations visiting China;
- Organizing conferences, workshops and technical seminars;
- Researching and publishing technical documents, including journals and reports;
- Recommending policies on coalbed methane recovery and use to government agencies.

With regard to the USEPA sponsored project Coal Mine Methane Market Development in China, the Clearinghouse prepares data packages of coal mine methane projects in 8 key mining areas, including Panjiang, Jincheng, Huainan, Huaibei, Fushun, Yangquan, Pingdingshan and Jiaozuo, and disseminate these data packages to interested investors and developers for international technical and economic cooperation in CMM projects. This data package of Huainan is prepared by Mr. Huang Shengchu, Ms. Liu Xin, Mr. Zhu Chao and Mr. Xu Huijun of the CBMC, Mr. Zhang Bingguang, Mr. Li Benyun and Mr. Cheng Gonglin of the Huainan Mining Group Co., Ltd., and reviewed by Mr. Karl Schultz of USEPA and Mr. Yuan Liang of the Huainan Mining Group Co., Ltd. The Clearinghouse also acknowledges the input from the Raven Ridge Resources Inc.



Mr. Yuan Liang (middle), chief engineer of the Company, and his colleagues attend the Workshop to discuss with US specialists Mr. Ray Pilcher (third from left) and Mr. Jay Rothstein (fifth from left) on international cooperation in CMM projects.



CMM is used as boiler fuel.



Seven permanent underground gas drainage systems are in operation in Huainan mining area with the total capacity of 143 million m³ per year.



Great Potential for CMM Recovery in Huainan Mining Area

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